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INGRASSIA FISHER & LORENZ, P.C. 7150 E. CAMELBACK, STE. 325 SCOTTSDALE, AZ 85251			RODGERS, COLLEEN E	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 09/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/705,579

Applicant(s)

KAILASAM ET AL.

Examiner

Colleen E. Rodgers

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 04 August 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-54 is/are pending in the application.
- 4a) Of the above claim(s) 29-54 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-19 and 21-28 is/are rejected.
- 7) ☒ Claim(s) 10 and 20 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 11/10/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

1. Claims 29-54 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 4 August 2006.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by **Nogami et al** (USPN 6,214,731).

Regarding claim 1, **Nogami et al** disclose a method for depositing copper overlying a work piece, the method comprising the steps of:

depositing overlying the work piece **10** a barrier layer **12** having a surface;

subjecting said surface of said barrier layer to a surface treatment adapted to facilitate

deposition of copper on said barrier layer [see col. 5, lines 9-13]; and

electrochemically depositing copper **16A** overlying said barrier layer [see col. 3, lines 13-17].

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Regarding claim 2, **Nogami et al** disclose the method of claim 1, wherein the step of electrochemically depositing copper is by electroplating [see col. 3, lines 13-17].

Regarding claim 3, **Nogami et al** disclose the method of claim 1, wherein the barrier layer comprises tungsten [see col. 3, lines 5-9].

Regarding claim 4, **Nogami et al** disclose the method of claim 1, wherein the step of subjecting said surface of said barrier layer to a surface treatment comprises the step of forming a protective layer **14** that overlies said surface and inhibits oxidation of said surface.

Regarding claim 5, **Nogami et al** disclose the method of claim 4, wherein the step of forming a protective layer comprises exposing the barrier layer to a gas comprising silane [see col. 3, lines 9-13].

4. Claims 1-4, 12, 19 and 21 and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by **Itabashi et al** (USPN 6,300,244).

Regarding claim 1, **Itabashi et al** disclose a method for depositing copper overlying a work piece, the method comprising the steps of:

depositing overlying the work piece **2** a barrier layer **4** having a surface;

subjecting said surface of said barrier layer to a surface treatment adapted to facilitate deposition of copper on said barrier layer [see col. 9, lines 4-7]; and

electrochemically depositing copper **10** overlying said barrier layer [see col. 9, lines 41-51].

Regarding claim 2, **Itabashi et al** disclose the method of claim 1, wherein the step of electrochemically depositing copper is by electroplating [see col. 9 lines 41-51].

Regarding claim 3, **Itabashi et al** disclose the method of claim 1, wherein the barrier layer comprises titanium [see col. 8, line 65 to col. 9, line 1].

Regarding claim 4, **Itabashi et al** disclose the method of claim 1, wherein the step of subjecting said surface of said barrier layer to a surface treatment comprises the step of forming a protective layer **9** that overlies said surface and inhibits oxidation of said surface.

Regarding claim 12, **Itabashi et al** disclose the method of claim 1, wherein the step of depositing a barrier layer comprises the step of forming the barrier layer by CVD or sputtering [see col. 6, lines 36-37].

Regarding claim 19, **Itabashi et al** disclose the method of claim 1, wherein the step of subjecting said surface of said barrier layer to a surface treatment comprises exposing said surface of said barrier layer to an alkaline solution [see col. 9, line 34, wherein the solution of the electroless plating solution that forms protective layer **9** is given to have a pH of 12.8, which is alkaline].

Regarding claim 21, **Itabashi et al** disclose the method of claim 19, further comprising the step of exposing said surface of said barrier layer to an acidic solution after the step of exposing said surface to an alkaline solution and before the step of electrochemically depositing copper [see col. 9, lines 38-41].

Regarding claim 22, **Itabashi et al** disclose the method of claim 1, wherein the step of subjecting said surface of said barrier layer to a surface treatment comprises the step of applying to said surface of said barrier layer an anodic current [see Fig. 1b, wherein copper sheet **7** is an anode].

5. Claims 1-4, 7 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by **Lu et al** (US Patent Application Publication 2002/0076929).

Regarding claim 1, **Lu et al** disclose a method for depositing copper overlying a work piece, the method comprising the steps of:

depositing overlying the work piece **100** a barrier layer **110** having a surface;

subjecting said surface of said barrier layer to a surface treatment adapted to facilitate deposition of copper on said barrier layer [see paragraph 0008]; and

electrochemically depositing copper 124 overlying said barrier layer [see paragraph 0022].

Regarding claim 2, **Lu et al** disclose the method of claim 1, wherein the step of electrochemically depositing copper is by electroplating [see paragraphs 0004 and 0022].

Regarding claim 3, **Lu et al** disclose the method of claim 1, wherein the barrier layer comprises tantalum [see paragraph 0017].

Regarding claim 4, **Lu et al** disclose the method of claim 1, wherein the step of subjecting said surface of said barrier layer to a surface treatment comprises the step of forming a protective layer 112 that overlies said surface and inhibits oxidation of said surface.

Regarding claim 7, **Lu et al** disclose the method of claim 4, further comprising the step of removing said protective layer prior to the step of electrochemically depositing copper [see paragraph 0018].

Regarding claim 8, **Lu et al** disclose the method of claim 7, wherein the step of removing said protective layer comprises using an etchant [see paragraph 0019].

6. Claims 1-5, 13 and 14 are rejected under 35 U.S.C. 102(e) as being anticipated by **Shingubara et al** (US Patent Application Publication 2003/0068887).

Regarding claim 1, **Shingubara et al** disclose a method for depositing copper overlying a work piece, the method comprising the steps of:

depositing overlying the work piece 2 a barrier layer 4 having a surface;

subjecting said surface of said barrier layer to a surface treatment adapted to facilitate deposition of copper on said barrier layer [see paragraph 0030]; and

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electrochemically depositing copper 6 overlying said barrier layer [see paragraph 0042].

Regarding claim 2, **Shingubara et al** disclose the method of claim 1, wherein the step of electrochemically depositing copper is by electroplating [see paragraph 0042].

Regarding claim 3, **Shingubara et al** disclose the method of claim 1, wherein the barrier layer comprises tantalum [see paragraph 0026].

Regarding claim 4, **Shingubara et al** disclose the method of claim 1, wherein the step of subjecting said surface of said barrier layer to a surface treatment comprises the step of forming a protective layer 5 that overlies said surface and inhibits oxidation of said surface.

Regarding claim 5, **Shingubara et al** disclose the method of claim 4, wherein the step of forming a protective layer comprises exposing the barrier layer to a gas comprising nitrogen [see paragraph 0027].

Regarding claims 13 and 14, **Shingubara et al** disclose the method of claim 4, wherein the step of depositing a barrier layer and the step of performing a protective layer are performed in the same processing apparatus, and in the same processing chamber [see paragraph 0027].

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Nogami et al** (USPN 6,214,731). **Nogami et al** disclose the method of claim 4 as described above. **Nogami et al** do not

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disclose wherein the protective layer has a thickness no greater than about 20 Å. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the thickness of the protective layer provides unexpected results in the semiconductor device produced. One of ordinary skill in the art would be motivated to optimize the protective layer's thickness to provide for processing limitations.

9. Claims 11, 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Itabashi et al** (USPN 6,300,244).

Regarding claim 11, **Itabashi et al** disclose the method of claim 4 as described above, furthermore wherein the step of forming the protective layer comprises forming a copper film 9. **Itabashi et al** do not disclose wherein the protective layer has a thickness less than 20 Å. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also



*In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the thickness of the protective layer provides unexpected results in the semiconductor device produced. One of ordinary skill in the art would be motivated to optimize the protective layer's thickness to provide for processing limitations.

Regarding claims 23 and 24, **Itabashi et al** disclose the method of claim 22, but do not disclose wherein the anodic current has a magnitude in the range of about 1 to about 50 mA/cm<sup>2</sup>, nor that it is applied for a time in the range of 0.5 second to 10 seconds. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the magnitude of the anodic current, nor the time for which it is applied, provides unexpected results in the semiconductor device produced. One of ordinary skill in the art would be motivated to optimize the magnitude and time to provide for processing limitations and device performance.

10. Claims 6 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lu et al** (US Patent Application Publication 2002/0076929).

Regarding claim 6, **Lu et al** disclose the method of claim 4 as described above. **Lu et al** do not disclose wherein the protective layer has a thickness no greater than about 20 Å. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the thickness of the protective layer provides unexpected results in the semiconductor device produced. One of ordinary skill in the art would be motivated to optimize the protective layer's thickness to provide for processing limitations.

Regarding claim 11, **Lu et al** disclose the method of claim 4 as described above, furthermore wherein the step of forming the protective layer comprises forming a copper film 112. **Lu et al** do not disclose wherein the protective layer has a thickness less than 20 Å. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within

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prior art in general conditions is obvious). In this case, there exists no evidence of record that the thickness of the protective layer provides unexpected results in the semiconductor device produced. One of ordinary skill in the art would be motivated to optimize the protective layer's thickness to provide for processing limitations.

11. Claims 9, 15-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lu et al** (US Patent Application Publication 2002/0076929) in view of **Jung et al** (USPN 6,486,055).

Regarding claim 9, **Lu et al** disclose the method of claim 8. **Lu et al** do not disclose wherein the etchant comprises one of sulfuric acid, nitric acid and a combination of sulfuric acid and hydrogen peroxide. **Jung et al** disclose the step of exposing said surface of said barrier layer to an acidic solution which exposing the barrier layer to nitric acid [see col. 3, lines 33-37]. It would have been obvious to one of ordinary skill in the art at the time of invention to use nitric acid as an etchant because it is well known in the art that nitric acid is an extremely powerful oxidizing agent.

Regarding claim 15, **Lu et al** disclose the method of claim 1. **Lu et al** do not disclose wherein subjecting said barrier layer to a surface treatment comprises the step of exposing said surface of said barrier layer to an acidic solution. **Jung et al** disclose subjecting a barrier layer 20 to a solution containing EDTA (ethylenediaminetetraacetic acid) [see col. 7, lines 54-58]. It would have been obvious to one of ordinary skill in the art at the time of invention to subject a barrier layer to an electroless plating solution as disclosed by **Jung et al** because **Jung et al** teaches that this method can be used to beneficially deposit a copper seed layer selectively, rather than blanketing an entire surface.

Regarding claim 16, the prior art of **Lu et al** and **Jung et al** disclose the method of claim 15, furthermore comprising the step of exposing said surface of said barrier layer to an alkaline solution

of TMAH (tetraammoniumhydroxide) after the step of exposing said barrier layer to an acidic solution and prior to the step of electrochemically depositing copper.

Regarding claim 17, the prior art of **Lu et al** and **Jung et al** disclose the method of claim 15, wherein the step of exposing said surface of said barrier layer to an acidic solution comprises exposing the barrier layer to nitric acid [see col. 3, lines 33-37].

Regarding claim 18, the prior art of **Lu et al** and **Jung et al** disclose the method of claim 15. Neither **Lu et al** nor **Jung et al** disclose wherein the acidic solution has an acidic concentration of about 10% to about 60% by weight. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the acidic concentration provides unexpected results in the device produced. One of ordinary skill in the art would be motivated to optimize the acidic concentration to provide for processing limitations.

12. Claims 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lu et al** (US Patent Application Publication 2002/0076929) in view of **Noguchi et al** (USPN 6,764,950).

Regarding claim 19, **Lu et al** disclose the method of claim 1. **Lu et al** do not disclose wherein subjecting said barrier layer to a surface treatment comprises the step of exposing said

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surface of said barrier layer to an alkaline solution. **Noguchi et al** disclose subjecting a barrier layer 6 to an alkaline solution during a chemical-mechanical polishing process [see col. 19, line 61 to col. 20, line 5]. It would have been obvious to one of ordinary skill in the art at the time of invention to subject the barrier layer to an alkaline solution as taught by **Noguchi et al** because **Noguchi et al** disclose that an alkaline solution beneficially neutralizes any oxidizing agent present.

Regarding claim 21, the prior art of **Lu et al** and **Noguchi et al** disclose the method of claim 19, further comprising the step of exposing the barrier layer to an acidic solution after exposing the barrier layer to the alkaline solution, in order to remove particles from the surface [see col. 19, line 61 to col. 20, line 5].

13. Claims 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lu et al** (US Patent Application Publication 2002/0076929) in view of **Ding et al** (USPN 6,790,776).

Regarding claim 25, **Lu et al** disclose the method of claim 1. **Lu et al** do not disclose wherein the step of subjecting said surface of the barrier layer to a surface treatment comprises applying an initial cathodic pulse. **Ding et al** disclose connecting a substrate with a barrier layer 34 thereover to a cathodic current [see col. 3, lines 8-15]. It would have been obvious to one of ordinary skill in the art to apply a cathodic current to the barrier layer because **Ding et al** teaches that it is well known in the electroplating art.

Regarding claims 26 and 27, the prior art of **Lu et al** and **Ding et al** disclose the method of claim 25. Neither **Lu et al** nor **Ding et al** disclose wherein the cathodic current has a magnitude in the range of about 25 to about 200 mA/cm<sup>2</sup>, nor that it is applied for a time in the range of 0.5 second to 10 seconds. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935,

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1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the magnitude of neither the cathodic current, nor the time for which it is applied, provides unexpected results in the semiconductor device produced. One of ordinary skill in the art would be motivated to optimize the magnitude and time to provide for processing limitations and device performance.

Regarding claim 28, the prior art of **Lu et al** and **Ding et al** disclose the method of claim 25. Furthermore, **Ding et al** disclose wherein an anodic current is applied after application of an initial cathodic current [see col. 3, lines 15-17].

14. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Shingubara et al** (US Patent Application Publication 2003/0068887). **Shingubara et al** disclose the method of claim 4 as described above. **Shingubara et al** do not disclose wherein the protective layer has a thickness no greater than about 20 Å. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of

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result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the thickness of the protective layer provides unexpected results in the semiconductor device produced. One of ordinary skill in the art would be motivated to optimize the protective layer's thickness to provide for processing limitations.

### ***Allowable Subject Matter***

15. Claims 10 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to teach or make reasonably obvious wherein the protective layer is removed by a copper plating solution (as required by claim 10), nor that the barrier layer is exposed to an alkaline solution formed from one of the group consisting of sodium hypochlorite, potassium hypochlorite, sodium chlorite, potassium chlorate, sodium perchlorate, potassium perchlorate and potassium permanganate (as required by claim 20).

### ***Conclusion***

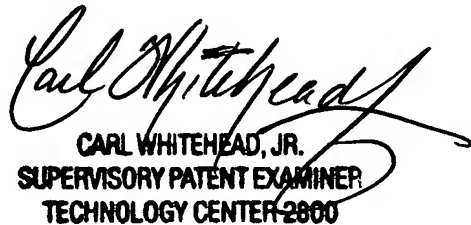
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen E. Rodgers whose telephone number is (571) 272-8603. The examiner can normally be reached on Monday through Friday, 9:00 AM to 6:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CER

  
CARL WHITEHEAD, JR.  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800